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Comparative Growth Performance and Feed Utilization of Four Local Strains of Nile Tilapia (*Oreochromis niloticus* L.) Collected From Different Locations in Egypt

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مقارنة أداء النمو والتحويل الغذائي لسلالات مختلفة من البلطى النيلى مجمعة من مناطق مختلفة من مصر

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فى هذه الدراسة جمعت سلالات مختلفة من البلطى النيلى من بحيرات ناصر (أسوان) والمنزلة ومريوط بالإضافة إلى أسماك البلطى النيلى من المزرعة السمكية بالعباسة حيث تمت مقارنة أداء النمو لهذه السلالات . تغذت هذه السلالات على عليقة متزنة تحتوى على ٢٧% من البروتين لمدة ٩٠ يوما. أوضحت الدراسة أن أفضل نمو كان لأسماك سلالة أسوان و لم تختلف نسبة الإعاشة بين السلالات . لم يوجد اختلاف ملموس في محتوى البروتين فى جسم الأسماك فى سلالات العباسة و أسوان و المنزلة بينما كان أقل محتوى بروتين فى سلالة مريوط . كانت أقل نسبة تحويل للعلف (FCR) وأعلى كفاءة تحويل للبروتين (PER) مع سلالة أسوان. كذلك تحققت أعلى قيمة للانتاج البروتيني (PPV) مع سلالة المنزلة بينما كانت أقل قيمة مع سلالة العباسة. نستنتج من هذه الدراسة أن أسماك سلالة أسوان كانت الأفضل فى النمو و يمكن الاستفادة منها فى الاستزراع السمكى حيث أنها تعطى أفضل نمو عند مستوى معتدل من البروتين فى العليقة (٢٧% بروتين) مما يساعد فى خفض تكلفة التغذية و بالتالى خفض تكلفة الإنتاج.

Key Words: *Nile tilapia, local strains, growth performance, feed utilization, FCR, PER, PPY.*

ABSTRACT

Brood stocks of Nile tilapia (*Oreochromis niloticus* L.) were collected from Lakes of Nasser (Aswan), Manzalah, Maryut and Abbassa fishponds. Fingerlings of F1 of each strain was fed diet containing 27% CP for 90 days. The obtained results showed that Aswan strain was superior to other tilapia strains in growth performance. Survival rate was not significantly different among Nile tilapia strains. Crude protein contents in fish body was insignificantly different among Abbassa, Aswan and Manzalah strains, whereas the less protein content was observed in Maryut strain. There is no significant difference in total lipids content between Abbassa and Manzalah strains and between Aswan and Maryut strains. Ash contents did not significantly differ in all tilapia strains. The highest feed intake was observed in Aswan strain, while there was no significant difference in feed intake among other tilapia strains. The lowest FCR value was obtained in Aswan strain, whereas the higher ones were obtained in Abbassa and Manzalah strains. The maximum PER was recorded in Aswan strain, while the less ones were obtained in Abbassa and Manzalah strains. The maximum PPV value was obtained in Manzalah strain, whereas the lowest one was observed in Abbassa strain, and there was no significant difference between Aswan and Maryut strains. It can be concluded that Aswan strain was more efficient in feed utilization and protein turnover than the other strains.

Introduction

In Egypt, tilapias are widespread in the Nile River and its attributes as well as in the lakes. Nile tilapia, *Oreochromis niloticus* L., is an important food fish and is considered as the best species for culture because of its high tolerance to adverse environmental conditions, its relatively fast growth and it can be easily bred where it is extensively cultured in several countries in the world.

Tilapia intensive culture would require the formulation of efficient food with optimum potency to meet the protein requirements in fish culture [11] and the selection of genetic improved tilapia strain [7]. Therefore, identification of relatively fast growing individuals early in their life cycle has important applications in genetic selection programs in aquaculture management [18]. For effective selection, it is important to understand the growth characteristics of individuals or groups of individuals under communal stocking in target fish farming environments.

To realize the maximum potentiality of Nile tilapia culture, genetic improvement programs are needed to develop adapted farm races of the species [2, 8]. There is no comparative data available on the growth of different tilapia strains in Egypt. Therefore, this study was carried out to compare the growth performance and feed utilization of different strains of Nile tilapia, *Oreochromis niloticus* L. collected from lakes of Nasser (Aswan), Manzalah, Maryut as well as Abbassa fishponds. That would help to reduce the costs and maximize the feed conversion efficiency.

Materials and Methods

The experimental design

Healthy parents of Nile tilapia; *Oreochromis niloticus* L. were collected from Nasser Lake at Aswan, Maryut Lake and Manzalah Lake as well as fishponds of Central Laboratory for Aquaculture Research, Abbassa, Abo-Hammad, Sharqia, Egypt. The rearing and successive processes for fry production (F 1) of each strain were carried out in Department of Fish Genetic and Breeding, Central Laboratory for Aquaculture Research, Abbassa, AboHammad, Sharqia. Fish weighing 10-15 g/fish were acclimated in indoor tanks for 2 weeks to laboratory conditions. Fifty fish were frozen at -20 °C for chemical analyses. The fingerlings of mixed sex were distributed randomly at a rate of 20 fish/aquarium in glass aquaria of 130-liter capacity containing 100 liter aerated water. Each aquarium was supplied with compressed air via air-stones from air pumps. Well-aerated water supply was provided from a storage fiberglass tank. The temperature was adjusted at 27±1°C by using thermostatically controlled heaters. Siphoning a portion of water from each aquarium was done every day for excreta removing and an equal volume of freshwater replaced it. Dead fish were removed and recorded daily.

Fish diets and feeding regime

A semi-moist basal diet was prepared from purified ingredients and was used to formulate an identical diet containing 91.8% dry matter, 27.4% crude protein, 6.4% total lipids, 6.6% ash and 438.4 kcal/g gross energy. Three aquaria were randomly assigned for each tilapia strain. Fish were fed frequently at a rate of 3% of live body weight twice daily for five days a week for 90 days. Fish in each aquarium was biweekly weighed and the amount of given feed was accordingly readjusted. The amount of consumed feed for each aquarium was subsequently calculated.

Proximate analysis of diet and fish

The tested diet and fish from each treatment were chemically analyzed according to the standard methods of AOAC (1990) for dry matter, protein, fat and ash. Dry matter content was estimated by heating samples in an oven at 85°C till constant weight and calculating weight loss. Nitrogen content was measured using a micro Kjeldahl apparatus and crude protein was estimated by multiplying nitrogen content by 6.25. Total lipids content was determined by ether extraction for 16 hr and ash was determined by combusting samples in a muffle furnace at 550 °C for 6 hr.

Growth parameters

Growth performance was determined and feed utilization was calculated as follows:

$$\text{Weight gain} = W2 - W1$$

Specific growth rate (SGR) = 100 (in W2 -in W1) / T

Where W1 and W2 are the initial and final fish weight, respectively, and T is the number of days in the feeding period.

Feed conversion ratio (FCR) = Feed intake / Weight gain
Protein efficiency ratio (PER) = Weight gain / Protein intake
Protein productive value (PPV) = Protein gain / Protein intake

Statistical analysis

Data of growth, feed utilization, survival rate and proximate chemical composition of whole fish body of each strain were subjected to one-way ANOV A following Snedecor and Cochran (1982), and differences between means were done at the 5% probability level using Duncan's new multiple range test (Duncan, 1955).

Results

Data in Fig. 1 show that the highest final weight was obtained in Aswan strain (37.3 g/fish), while other strains exhibited approximately similar final weights (29.8, 28.7 and 30.9 g/fish for Abbassa, Manzalah and Maryut strains, respectively). Similarly, data of weight gain and specific growth rate (SGR) exhibit the same trend (Table 1).

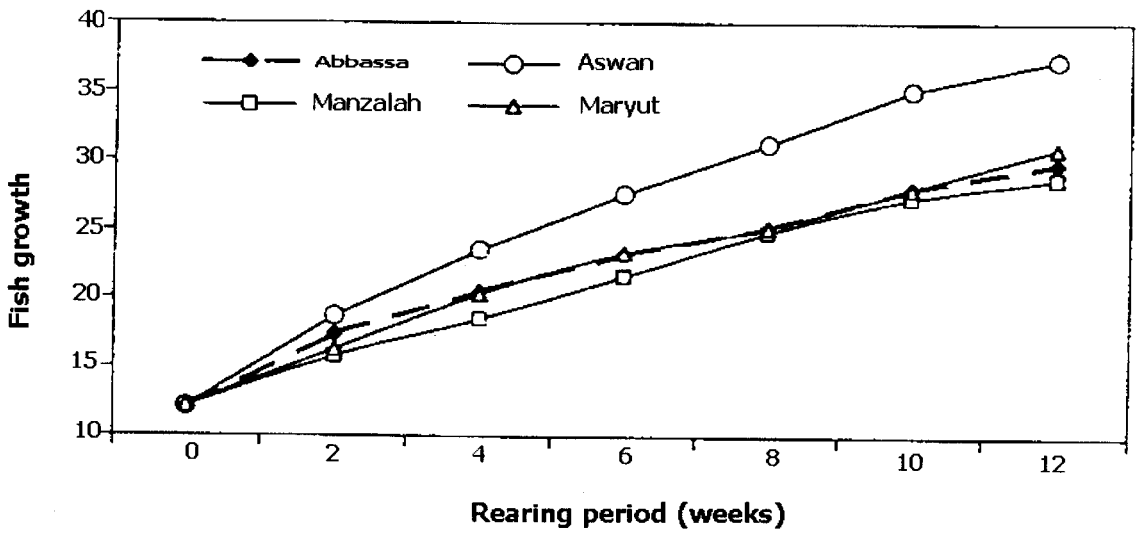

Fig. 1: Changes in live body weight (g/fish) of different strains of Nile tilapia *(0. niloticus* L.) fed diet containing 27% CP.

Table 1: Growth performance of different strains of Nile tilapia *(0. niloticus* L.) fed diets containing 27% CP.

Tilapia strains	Final wt. (g/fish)	Weight gain (g/fish)	SGR (%/d)	Survival rate (%)
Abbassa	29.8b ± 0.8	17.8b ± 0.8	1.003b ± 0.03	96.7a ± 2.04
Aswan	37.3a ± 0.8	25.2a ± 0.8	1.277a ± 0.03	93.3a ± 2.04
Manzalah	28.7b ± 0.8	16.6b ± 0.7	0.976b ± 0.03	100.0a ± 0.0
Maryut	30.9b ± 1.3	18.7b ± 1.3	1.059b ± 0.05	100.0a ± 0.

Figures in the same column not having the same letters are significantly different (P<0.05).

Results of body composition of each fish strain fed diet containing 27% CP are summarized in Table 2. Crude protein contents in fish body were insignificantly different among Abbassa, Aswan and Manzalah strains (55.7%, 54.8% and 55.9%, respectively), whereas the less protein content was observed in Maryut strain (53.5%; P<0.05).

Table 2: Carcass proximate chemical analyses (mean ± SE) of different strains of Nile tilapia; *O. niloticus* L. fed diets containing 27% CP.

Tilapia strains	Items (%)			
	Dry matter	Crude protein	Ether extract	Ash
Abbassa	22.1 b ±0.1	55.7 a ± 0.2	23.9 b ± 0.6	20.4 a ± 0.5
Aswan	23.9b ± 0.1	54.8 ab ± 0.2	25.1 a ± 0.2	20.1 a ± 0.3
Manzalah	26.9 a ± 0.9	55.9a ± 0.4	23.0b ± 0.2	21.1 a ± 0.3
Maryot	26.1 a ± 0.6	53.5 b ± 0.2	25.2 a ± 0.3	21.3 a ± 0.28

Figures in the same column not having the same letters are significantly different (P<0.05).

On the other hand, fish body of Abbassa and Manzalah strains contained similar values of total lipids (23.9% and 23.0%, respectively). Also, there is no significant difference in total lipids content between Aswan and Maryut strains (25.1% and 25.2%, respectively). Ash contents did not significantly differed in all tilapia strains and ranged from 20.1 % to 21.3% (P>0.05).

Results of feed intake, feed conversion ratio (FCR), protein efficiency ratio (PER) and protein productive value (PPV) are significantly different from one tilapia strain to another (Table 3). The highest feed intake was observed in Aswan strain only (45.4 g feed/fish), while there were no significant differences in feed intake among other tilapia strains (36.1-39.3 g feed/fish). In contrast, the lowest FCR value was obtained with Aswan strain (1.80), whereas the higher ones were obtained with Abbassa and Manzalah strains (2.21 and 2.17, respectively). Concerning PER, the maximum value was recorded with Aswan strain (2.20), while the less ones were obtained with Abbassa and Manzalah strains (1.79 and 1.82, respectively). In case of PPV, the maximum PPV values was obtained with Manzalah strain (30.7%), whereas the lowest one was observed with Abbassa strain (20.97%). There was no significant difference between Aswan and Maryut strains (28.83% and 28.47%, respectively).

Table 3: Feed intake, feed conversion ratio (FCR), protein efficiency ratio (PER) and protein productive value (PPV) by of different strains of Nile tilapia; *O. niloticus* L. fed diet containing 27% CP.

Tilapia strains	Feed intake (g feed/fish)	FCR	PER	P P V (%)
Abbassa	39.3 b ± 1.3	2.21 a ± 0.09	1.79 c ± 0.05	20.97 c ± 0.49
Aswan	45.4 a ± 1.2	1.80 c ± 0.05	2.20 a ± 0.06	28.83 b ± 0.49
Mlanzalah	36.1 b ± 0.9	2.17 a ± 0.07	1.82 c ± 0.05	30.70 a ±0.71
Maryot	38.0 b ± 1.1	2.03 b ± 0.04	1.95 b ± 0.05	28.47 b ± 0.64

Figures in the same column not having the same letters are significantly different ($P<0.05$).

It is worth mentioning that Aswan strain was more efficient in feed utilization and protein turnover than the other strains since the higher growth performance with higher PER and less FCR values were observed in Aswan strain.

Discussion

The culture of Nile tilapia is probably suffering from genetic founder and bottleneck effects [15]; genetic deterioration of cultured stocks due to widespread introgression of genes from other less desirable feral tilapia species and possible inbreeding (Macaranas *et al.,* 1986). However, the expected genetic differences between groups of fish have been widely accepted as a valid technique for the efficient selection of the optimum strain that could be utilized for development of fish [9].

A number of studies in recent years have demonstrated that there are large differences in the relative culture performance of different populations and strains of tilapia across a range of different environments. In fish, and particularly in tilapia, strains or isolates are normally loosely designated according to their location or origin, and commonly have no distinctive traits, which can lead to considerable confusion [13].

In the most comprehensive study of this kind, [9] and [14] compared the growth performance of eight different strains of Nile tilapia reared in different farm environments. The strains included four African strains collected from Egypt (E1 & E2), Ghana, Kenya and Senegal, and four established Asian farmed strains known as Israel, Singapore, Taiwan and Thailand. They found that, the African strains performed as well as or better than the Asian strains and the fast growth was obtained in the strain of Egypt, while the lowest one was obtained in the strain of Ghana. They attributed this difference to strain-specific effects of reproduction on growth. They also found that the Least significant Mean of E1 and E2 were not significantly different. The imported Egyptian strain in the investigation of [9, 14] was firstly collected from lake Manzalah, from lakes around Alexandria and from creeks along the desert road to Port Said (El) and another collection was obtained from Abbassa and Ismailia (E2).

A further study on stocks established as pure Nile tilapia was conducted in [3]. The author compared the growth performance of 11 strains of tilapia from various African origins and found similar results in that the strains of Egyptian origin had the fastest growth rate, although the performance of three Kenyan strains were relatively poor.

On the other hand, [4] evaluated the culture performance of overwintered fry of three strains of Nile tilapia; collected from Vietnam (Viet), ICLARMPhilippines (GIFT) and Thailand (Thai). They found that, among the three strains, the GIFT strain reached a larger individual size in both cages and ponds at final harvest than either the Thai or Viet strains. However, the GIFT fish grew fastest and attained a significantly larger individual final weight compared to the other strains. Moreover, no significant difference in survival rate was observed among the different strains.

In growth trails of tilapia species and strains, changes in ranking of strains between environments are common, indicating significant genotype x environment interactions in many cases [3, 5, 10, 16]. However, in the study of [9], the analysis of the performance of the strains across environments led to the conclusion that the relative importance of genotype environment interaction was low compared to that of strain and sex differences.

Results in this study reveal that the growth of different local strains of Nile tilapia was significantly different where Aswan strain is the optimum one for fish farming and tilapia intensification in Egypt. However, it realized the optimum growth and feed utilization at moderate dietary protein level of 27% CP. Therefore, it could be recommended that the hatcheries of Nile tilapia should renew their broad stock used for fry production from Nasser lake at Aswan.

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